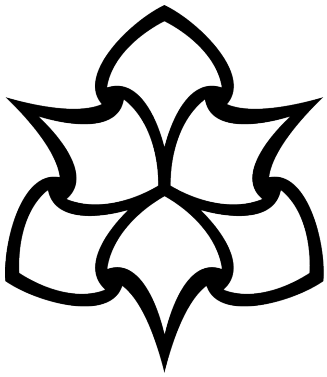

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Longitudinal Associations between Narcissism, Mental Toughness and School Achievement

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Conflict of interest

All authors declare no conflicts of interest.

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Author Contributions

K.A.P. has written the manuscript with the contribution of M.M. and A.D.; K.A.P., M.M. and A.D. have performed the statistical analyses; M.M., N.S. and K.S. were responsible for data collection and data preparation; P.J.C. and Y.K. provided critical reviews and comments during the write-up of this manuscript. K.A.P. was responsible for the conceptualisation of the study that is presented in this manuscript; M.M., N.S. and K.S are the directors of the MILES project.

Highlights (for review)

- Mental Toughness correlated positively with subclinical narcissism in adolescence
- Mental Toughness predicted a small percentage of the variation in school achievement
- Narcissism exerted a significant positive indirect effect on school achievement through MT
- MT, narcissism and achievement were all highly stable over time
- Inclusion of narcissism in the dark triad of personality traits may need to be reconsidered

Longitudinal Associations between Narcissism, Mental Toughness and School Achievement

Abstract

Mental Toughness has been associated with optimal performance across diverse contexts including academic achievement. MT is positively associated with subclinical narcissism. Cross-sectional research reported that high narcissism may contribute indirectly to enhanced positive outcomes, through MT. This study is the first to explore longitudinally the development of the association between MT, narcissism and achievement in a sample of adolescents. MT correlated positively with narcissism and predicted a small percentage of the variation in school achievement. Narcissism did not correlate significantly with school achievement. However, subclinical narcissism exerted a significant positive indirect effect on school achievement through MT. The findings suggest that the relationship between narcissism and MT could be one of the non-cognitive mechanisms that underlie individual variation in school achievement.

Keywords: longitudinal design, mental toughness, subclinical narcissism, school achievement.

1.0 Introduction

There is increasing interest in studying the role of non-cognitive traits in contributing to variation in academic attainment across development (e.g. Dumfart & Neubauer, 2016). Several non-cognitive traits have been identified as buffers against the negative impact of stressful situations on performance in education. These include *grit* (Duckworth, Peterson, Matthews, & Kelly, 2007); *motivation* (Lepper, Corpus, & Iyengar, 2005); *resilience* (McGeown, St Clair-Thompson, & Clough, 2016); and *hardiness* (Kobasa, 1979). Mental Toughness (MT) has been suggested as a construct that may subsume the aforementioned concepts (see Bahmani et al., 2016).

1.1 Mental Toughness, Learning and Educational Achievement

MT is a personality trait that includes an array of positive characteristics such as perceiving challenge as an opportunity rather than a threat and feeling in control of life situations (Clough, Earle, & Sewell, 2002). MT reflects an effective coping mechanism in reaction to stressors and it facilitates proactively seeking out opportunities for personal growth (St Clair-Thompson et al., 2015). MT correlates with personality traits that are established predictors of performance in diverse settings (Lin, Mutz, Clough, & Papageorgiou, 2017). For example, a study reported positive correlations between MT, extraversion, openness to experience, agreeableness, and conscientiousness; and negative correlations between MT and neuroticism (Horsburgh, Schermer, Veselka, & Vernon, 2009). Another study showed evidence for the existence of a general factor of personality representing high levels of MT, extraversion, and conscientiousness as well as low levels of neuroticism (Veselka, Schermer, Petrides, & Vernon, 2009).

Clough and colleagues (2002) characterised MT as a composite of four (the 4Cs) strongly

correlated but independent subcomponents: (1) *control* (life and emotion): the tendency to feel and act as if one is influential and keep anxieties in check; (2) *commitment*: the tendency to be deeply involved in pursuing goals despite difficulties that arise; (3) *challenge*: the tendency to see potential threats as opportunities for self-development and to continue to strive in changing environments; and (4) *confidence* (in abilities and interpersonal): the belief that one is a truly worthwhile person in spite of setbacks, and the ability to push oneself forward in social settings.

Previous research has shown that MT is an important concept for explaining individual differences in learning and educational performance (McGeown et al., 2016). For example, positive correlations were found between total MT, academic attainment (r = .22), attendance (r = .22; St Clair-Thompson et al., 2015), social inclusion (r = .22) and social acceptance (r = .38) in adolescents (St Clair-Thompson et al., 2015). Another study showed that MT was correlated negatively with oppositional behaviour (r = -.23), inattention (r = -.17) and hyperactivity (r = -.14) in adolescents (St Clair-Thompson et al., 2015).

Individual differences in MT also associate with individual variation in undergraduate students' performance in learning and education. For example, a study reported positive correlations between MT, grades and progression (r = .31and r = .25, respectively; Crust et al., 2014) in undergraduate students. Positive associations were also reported between MT and positive emotions (R^2 = .75), thriving (R^2 = .87), and academic (R^2 = .53) and social goal progress (R^2 = .45) over 10 weeks in undergraduates (Gucciardi, Hanton et al., 2015). Another study reported that the 4Cs were positively associated with self-esteem (r = .23 for the subscale of control of emotions to .83 for the subscale of confidence) and college adjustment (r = .19 to .70); and negatively associated with school concerns (r = -.27 to -.52) in undergraduate students

(St Clair-Thompson et al., 2015). The particularly high correlation between self-esteem and confidence (reported in St Clair-Thomson et al., 2015) is to be expected and it has been acknowledged by a number of authors and approaches (e.g. Cashmore, 2002; Crust, 2008). However, MT represents a number of additional (to self-esteem) psychological constructs including *Seeking out challenge*; *Motivation to achieve*; *Persistence* and *Resilience* (Clough et al., 2002).

Recently a study explored the association between MT and academic grades and attendance in a sample of university students. Commitment and control together accounted for 16.5% of the variance in total average grade (Lin et al., 2017). These studies suggest that MT is an important trait in relation to educational outcomes with implications for educational practice.

1.2 Narcissism and Mental Toughness

Subclinical narcissism includes facets retained from the clinical syndrome, namely grandiosity, entitlement, dominance, and superiority (Paulhus & Williams, 2002). Previous studies suggested that narcissism might be unique among the DT traits in that, it encapsulates to a larger extent (in comparison to psychopathy and Machiavellianism), prosocial and adaptive behaviours (e.g. Veselka et al., 2012). Petrides et al. (2011) used a sample of twins and reported that—unlike psychopathy and Machiavellianism—narcissism correlates positively (r = .20 for twin 1 and r = .22 for twin 2) with emotional intelligence. The authors suggested that the heightened sense of self-worth may render a narcissist optimistic, motivated, assertive, and successful in relationships (Petrides et al., 2011).

Three studies have explored the relationship between subclinical narcissism and MT in adults (Onley et al., 2013; Sabouri et al., 2015; Papageorgiou, Wong, & Clough, 2017). All three

studies reported significant and positive associations between the two traits (r = .13 – .21 between the 4Cs and narcissism; r = .50 for total MT and narcissism; r = .21 for total MT and narcissism, respectively). Furthermore, Papageorgiou et al. (2017) showed that, despite being part of the dark triad, narcissism exerted a significant negative indirect effect on both psychopathy and Machiavellianism through MT. This statistical model suggests that subclinical narcissism could increase MT contributing indirectly to positive outcomes.

1.3 The Current Study

The current study aimed to: (1) Extend previous findings, derived from adult samples, on the association between subclinical narcissism and MT in an adolescent sample; (2) Explore longitudinally the degree to which individual differences in MT and subclinical narcissism predict individual variation in school achievement; (3) Test a mediation model suggesting that narcissism increases MT, which subsequently contributes to higher school achievement. We hypothesised that:

1. MT will correlate positively with subclinical narcissism in adolescence.
2. MT and subclinical narcissism will correlate positively with school achievement.
3. MT, narcissism and achievement will associate to each other longitudinally and will show high stability over time.
4. Narcissism will exert a positive indirect effect on school achievement through MT.

2.0 Method

2.1 Sample

Participants are part of the Multi-Cohort Investigation into Learning and Educational Success (MILES). Wave 1 and Wave 2 ((N = 927 and N = 561, respectively after data cleaning and screening) include students recruited from three different Italian high schools in the Milan Province. The present investigation includes students who participated in MILES at both wave 1 (March 2016) and wave 2 (June 2016). In total 339 students took part in both collection waves (54% females). Participants' ages ranged between 14 and 21 (M= 15.63, SE= 1.40, in wave 1 and M=15.83, SE=1.40, in wave 2). Students with a diagnosis of learning difficulties were excluded from the current analyses. MILES received ethical approval from XXXXXXXXXX and the parents' and teachers' committees of every school that approved the MILES protocol.

2.2 Procedure

All students were invited to take part in the study. The data were collected online using the forepsyte.com online platform (www.forepsyte.com). Students took part in both testing sessions at home or on the school's computers after classes. Participants were given an individualised ID, which they used to access the web study. The ID codes and corresponding names are stored in a separate secure server from the rest of the data. An information sheet, consent form and debrief form were included at both collection waves. The first wave lasted around 90 minutes; the second wave around 45 minutes.

2.3 Measures

2.3.1 Mental Toughness. The newly developed ten-item Mental Toughness Questionnaire (MTQ-10) has been used to assess total MT at wave 1 and wave 2. Originally, a 12-item measure derived by taking the two highest line adding items of the MTQ48 in each of the six sub scales. We then performed a Confirmatory Factor Analysis (CFA) on the 12-item

measure and resulted in the 10-item version due to poor factor loading for two of the 12 items. The initial CFA on the resultant 12 items from EFA provided unsatisfactory data-model fit on all indices but SRMR, $\chi 2$ (54, N = 343) = 185.87, $p < .001$, *CFI* = .82, *IFI* = .82, *SRMR* = .07, *RMSEA* = .09 (CI of .08 to .11). An inspection of factor loadings revealed that item 7 and item 11 loaded poorly on the general factor (.27 and .22 respectively), and below the recommended threshold of .32 (see Tabachnick & Fidell, 2001). Removal of these items resulted in an improved model fit. The statistical analysis that was conducted to validate this new measure is described in detail in the Supplementary Material.

The MTQ-10 has an average completion time of 5 minutes with responses to its 10 items given on a 5-point Likert scale anchored at *1 = strongly disagree* and *5 = strongly agree*. Three items are reverse coded; the MT score represents the average score of the 10 items. Example item include "*I generally cope well with any problems that occur*".

2.3.2 Narcissism. The Short Dark Triad questionnaire (SD3) assesses subclinical narcissism, subclinical psychopathy and Machiavellianism and it has high reliability and validity, including construct validity and external validity (Jones & Paulhus, 2014). The SD3 includes 27 items, 9 for each scale with responses given on a 5-point Likert scale, with *1 = strongly disagree* and *5 = strongly agree*. We used only the 9 items that assess subclinical narcissism. Example items include: "*People see me as a natural leader*". The score for the subscale represents the average score of the 9 corresponding items.

2.3.3 School Grades. Students reported their grades in mathematics, literacy (Italian) and second language at the end of the first term (wave 1) and the second term (wave 2). Students' grades ranged from 4 to 10, where 10 indicated the highest possible grade, 6 represented pass, and 4 indicated a grade of 4 or lower. A mean composite score of the grades reported in

mathematics, literacy and second language was created as a measure of overall school achievement. Self-reported grades are regarded as a reliable measure of school achievement (Kuncel, Crede, & Thomas, 2005).

2.3.4 Cognitive Ability Measures. Students' cognitive ability was used as a covariate in the analyses. A 30-item online version of the Raven's Progressive Matrices test (Raven, Court, & Raven, 1996) was administered to assess *non-verbal reasoning*. The items were arranged in increasing level of difficulty. A discontinue rule was applied so that after three consecutively incorrect responses in one subsection, participants were re-directed to the next subsection.

The newly developed Italian Vocabulary Test (IVT-80; Malanchini et al., in preparation) was used to assess verbal ability. The test consisted of 80 items and it is loosely based on the Mill Hill vocabulary test (Raven, Raven, & Court, 1998). For every item, participants were presented with a word, and they were asked to select a synonym of that word, out of six options. Only one option was the correct one. The items were presented in order of frequency in the written Italian language, from words appearing more frequently, to words with appearing less frequently. For example, the word "Motive" was presented together with six possible synonyms: (a) leader, (b) activity, (c) change, (d) motion, and (e) reason – with option 'e' being the correct answer. A short version of the IVT including 35 items (IVT-35) was included at wave 2. The IVT showed good test-retest correlation over 4 months (r = .66, N = 339). The test and the reduced version both showed reasonable external validity as they shared moderate correlations with literacy school achievement (r = .36, N = 922 at wave 1; and r = .40, N = 522 at wave 2) and non-verbal reasoning (r = .42, N = 922). A mean composite score of the two tests was taken as an index of cognitive ability.

3.0 Results

3.1. Descriptive Statistics

Descriptive statistics for MT, subclinical narcissism, school grades and school achievement are presented in Table S1 in the Supplementary Material. Table 1 presents test-retest reliabilities for MT, subclinical narcissism, school grades and school achievement.

Table 1 should be placed here

3.2. Associations between Mental Toughness, Narcissism and School Achievement

Table 2 presents the correlations between school grades for wave 1 and wave 2, respectively.

Table 2 should be placed here

Partial correlations (controlling for age and sex) showed that subclinical narcissism (wave 1) correlated positively with MT at wave 1 (r = .38, p < .001, 95% CI [0.28, 0.47]). Subclinical narcissism (wave 2) correlated positively with MT at wave 2 (r = .34, p < .001, 95% CI [0.23, 0.45]).

Multiple linear regression (controlling for age, sex and cognitive ability) was used to explore the associations between MT and narcissism at wave 1 and wave 2 with school achievement (wave 1 and wave 2, respectively). Longitudinal associations between MT (wave 1) with grades in mathematics (wave 2), literacy (wave 2) and second language (wave 2); and between narcissism (wave 1) with grades in mathematics (wave 2), literacy (wave 2) and second language (wave 2) are presented in the supplementary material in Tables S2 and S3, respectively.

MT at wave 1 was associated significantly with school achievement at wave 1 (β = .10, R^2 = .01, p < .05). MT at wave 2 was associated significantly with school achievement at wave 2 (β = .13, R^2 = .016, p < .05). MT at wave 1 was associated significantly with school achievement at wave 2 (β = .11, R^2 = .012, p < .05). When all covariates were excluded from the model, the predictive value of MT at wave 1 on school achievement at wave 2 increased (β = .16, R^2 = .026, p < .01). When cognitive ability only was excluded from the model, the predictive value of MT at wave 1 on school achievement at wave 2 increased significantly (β = .19, R^2 = .032, p < .01). Narcissism at wave 1 was not associated significantly with school achievement at wave 1 (β = -.02, R^2 = .00, p = .67). Narcissism at wave 2 was not associated significantly with school achievement at wave 2 (β = .009, R^2 = .00, p = .85). Narcissism at wave 1 was not associated significantly with school achievement at wave 2 (β = - .03, R^2 = .001, p = .55).

Table 3 should be placed here

3.3 Cross-lagged Analysis

Figure 1 presents a cross-lagged model exploring the longitudinal relations between narcissism, MT and school achievement across the two collection waves. All variables were age regressed and standardised prior to model fitting. The model was a good fit for the data (*CFI* = 1.00, *TLI* = 1.00, *RMSEA* = .000, *SRMR* = .00). MT was found to be stable over time (β = .727, p < .001), and strong stability was also observed for school achievement (β = .822, p < .001) and narcissism (β = .685, p < .001). The concurrent relation between MT and narcissism at wave 1 was moderate (r = .424, p < .001). The two variables also shared a modest correlation at wave 2 beyond their correlation at wave 1 (r = .232, p < .001). The correlation between MT and achievement at wave 1 was weak but significant (r = .147, p < .001), and the two constructs

shared a weak correlation at wave 2 (r = .138, p < .01). Narcissism and achievement were not correlated at wave 1, but they shared a weak association at wave 2 (r = .135, p < .01).

Figure 1 should be placed here

3.4 Mediation Effect of Mental Toughness on Narcissism and School Achievement

The absence of a direct association between narcissism and achievement does not preclude the possibility that they are indirectly associated though their mutual relation with MT. Figure 2 illustrates our proposed mediation model: In line with the hypothesis, the indirect effect of narcissism (Wave 1) on school achievement (Wave 2), through individual differences in MT (Wave 2), was positive and statistically significant (b = 0.08, SE = 0.03, 95% CI [0.032, 0.162]).

Figure 2 should be placed here

4.0 Discussion

The present study explored longitudinally the contribution of MT and subclinical narcissism in educational achievement. The results extended previous cross-sectional findings in adult samples (e.g. Papageorgiou et al., 2017) showing a positive and moderate association between MT and subclinical narcissism, across both collection waves, in an adolescent sample. This finding provides further support to previous evidence (see for example, Onley et al., 2013) indicating that narcissism encapsulates prosocial and adaptive behaviours.

The results also showed that MT associates positively with school achievement. Additional analysis on the association between MT and school grades showed that MT associates more strongly with school grades in literacy than in mathematics and foreign language. This finding requires further investigation as it suggests that MT may be more relevant to certain

aspects of academic attainment (such as in literacy) as compared to others (such as in mathematics). However, the variance in school achievement and grades that was explained by MT was very small, which poses difficulties in terms of making inferences about the practical value of these results. It is possible that non-cognitive traits, such as MT, may be stronger predictors of academic performance in higher education in comparison to lower levels of education. This could be due to the fact that university samples tend to exhibit less individual variation in intellectual ability as a result of students being selected on the basis of similar academic performance in high school (Furnham, Chamorro-Premuzic, & McDougall, 2002).

We do think however that MT has an important role to play in school achievement. A possible explanation for the difference between the current findings and previous research is differences in the measures that were used in this study and in previous studies. Specifically, the MTQ-10 may not capture the full amount of individual variation on MT offering lower explanatory power in relation to performance outcome. More importantly, however, we think that the scale of self-reported school grades is not sensitive enough to capture the full amount of variation that exists in the lower end of the distribution (the scale ranges from 4 to 10 where 4 represents any score from 0 to 4). Future studies could assess longitudinally total MT and the 4Cs and employ additional measures of school achievement in order to test the predictive power of MT on school performance.

Cross-lagged analyses showed that MT, narcissism and achievement were all highly stable over time, which is indicative of the reliability of these constructs. The correlations between measures were significant beyond those observed at wave 1; this finding may suggest that the observed associations grow over time. The cross-lagged links between all constructs were not significant. This suggests that, even if the associations between MT, narcissism and

achievement grow over time; this growth is not a function of their direct mutual influences on each other. Oher factors, for example conscientiousness and openness to experience may influence the longitudinal association between MT and narcissism.

Mediation analysis showed that subclinical narcissism was positively associated with MT, which in turn was associated with higher school achievement. This is in line with recent findings (see Papageorgiou et al., 2017) suggesting that subclinical narcissism may increase MT, a trait that is relevant across achievement contexts, contributing indirectly to positive outcomes. Future studies could explore the role of MT and narcissism in other aspects of life, such as for example relationships, career aspirations and professional satisfaction.

The findings of the present research should be interpreted in light of some limitations. Responses in self-reported data may be influenced by common-method variance (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003) and social desirability, particularly in the context of the assessment of a "dark" trait (narcissism). Data collection from multiple raters could enhance the validity of the results. Moreover, scores for narcissism obtained using the SD3 might be biased towards assessing narcissism as a prosocial trait, linked to healthy self-esteem, rather than assessing the antisocial aspects of narcissism. Maples, Lamkin and Miller (2014) suggested that the SD3 narcissism scale measures primarily the grandiose aspects of this construct; while other short measures of this trait, such as the Dirty Dozen (Jonason & Webster, 2010) might capture both vulnerable and grandiose features of narcissism. Finally, the generalizability of the findings might be limited to the educational system of the country from which the sample has derived; future studies could attempt to replicate the results using cross-cultural data.

McGeown et al. (2016) have proposed recently that future research focusing on MT should make efforts to overcome some of the methodological weaknesses (e.g. lack of longitudinal data) to allow a greater and more comprehensive understanding of this concept within education. The current study presents novel findings on the stability of individual differences in MT and subclinical narcissism over the course of a school year. The findings do not provide strong evidence for excluding subclinical narcissism from the dark triad of personality traits. However, the notion that scoring high on subclinical narcissism may increase school performance, through MT, supports the idea of studying the contextual adaptive and maladaptive aspects of traits; instead of focusing on rigid dichotomies between prosocial versus socially malevolent personality traits.

References

Clough, P., Earle, K., & Sewell, D. (2002). Mental toughness: The concept and its measurement. In I. M. Cockerill (Ed.), *Solutions in sport psychology* (pp. 32-43). Boston, MA: Cengage Learning.

Cashmore, E. (2002) *Sport Psychology: The Key Concepts.* Routledge: London

Crust, L. (2008). A review and conceptual re-examination of mental toughness: Implications for future researchers. *Personality and Individual Differences, 45* (7), 576-583

Crust, L., Earle, K., Perry, J., Earle, F., Clough, A., & Clough, P. J. (2014). Mental toughness in higher education: Relationships with achievement and progression in first-year university sports students. *Personality and Individual Differences, 69*, 87-91.

Crust, L., & Clough, P. J. (2011). Developing mental toughness: from research to practice. *Journal of Sport Psychology in Action, 2*(1), 21-32.

Duckworth, A. L., Peterson, C., Matthews, M. D., & Kelly, D. R. (2007). Grit: perseverance and passion for long-term goals. *Journal of Personality and Social psychology, 92*(6), 1087-1101.

Dumfart, B., & Neubauer, A. C. (2016). Conscientiousness is the most powerful noncognitive predictor of school achievement in adolescents. *Journal of Individual Differences*, *37*(1), 8-15.

Furnham, A., Hughes, D. J., & Marshall, E. (2013). Creativity, OCD, narcissism and the Big Five. *Thinking Skills and Creativity, 10,* 91-98.

Gucciardi, D. F., Hanton, S., Gordon, S., Mallett, C. J., & Temby, P. (2015). The concept of mental toughness: Tests of dimensionality, nomological network, and traitness. *Journal of Personality, 83*(1), 26-44.

Jonason, P. K., & Webster, G. D. (2010). The Dirty Dozen: A concise measure of the dark tdad. *Psychological Assessment, 22,* 420-432.doi:10.1037/a0019265

Jones, D. N., &Paulhus, D. L. (2014). Introducing the Short Dark Triad (SD3) A Brief Measure of Dark Personality Traits. *Assessment, 21*(1), 28-41.

Kobasa, S. C. (1979). Stressful life events, personality, and health: an inquiry into hardiness. *Journal of Personality and Social Psychology, 37*(1), 1-11.

Kuncel, N. R., Crede, M., & Thomas, L. L. (2005). The validity of self-reported grade point averages, class ranks, and test scores: A meta-analysis and review of the literature. *Review of Educational Research, 75*(1), 63–82.

Lepper, M. R., Corpus, J. H., & Iyengar, S. S. (2005). Intrinsic and extrinsic motivational orientations in the classroom: Age differences and academic correlates. *Journal of Educational Psychology*, *97*(2), 184-196.

Lin, Y., Clough, P. J., Welch, J., & Papageorgiou, K. A. (2017). Individual differences in mental toughness associate with academic performance and income. *Personality and Individual Differences, 113,* 178-183.

Lin, Y., Mutz, J., Clough, P. J., & Papageorgiou, K. A. (2017). Mental Toughness and Individual Differences in Learning, Educational and Work Performance, Psychological Well-being, and Personality: A Systematic Review. *Frontiers in Psychology, 8*. doi: 10.3389/fpsyg.2017.01345

Maples, J. L., Lamkin, J., & Miller, J. D. (2014). A test of two brief measures of the dark triad: The dirty dozen and short dark triad. *Psychological assessment, 26*(1), 326.

McGeown, S. P., St Clair-Thompson, H., & Clough, P. (2016). The study of non-cognitive attributes in education: Proposing the mental toughness framework. *Educational Review, 68*(1), 96-113.

Onley, M., Veselka, L., Schermer, J. A., & Vernon, P. A. (2013). Survival of the Scheming: A Genetically Informed Link Between the Dark Triad and Mental Toughness. *Twin Research and Human Genetics, 16*(06), 1087-1095.

Papageorgiou, KA., Wong, B., & Clough, P. (2017). Beyond Good and Evil: Exploring the Mediating Role of Mental Toughness on the Dark Triad of Personality Traits. *Personality and Individual Differences, 119*, 19-23.

Petrides, K. V., Vernon, P. A., Schermer, J. A., & Veselka, L. (2011). Trait emotional intelligence and the dark triad traits of personality. *Twin Research and Human Genetics, 14*(01), 35-41.

Podsakoff, P. M., MacKenzie, S. B., Lee, J.-Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: a critical review of the literature and recommended remedies. *Journal of Applied Psychology, 88*(5), 879-903.

Raven, J., Raven, J. C., & Court, J. H. (1998). Advanced Progressive Matrices. Oxford, UK7 Oxford Psychologists Press.

Raven, J. C., Court, J. H., & Raven, J. (1996). Raven matrices progressivas manual. Madrid: Publicaciones De Psicologia Aplicada

Sabouri, S., Gerber, M., Bahmani, D. S., Lemola, S., Clough, P. J., Kalak, N., ... & Brand, S. (2016). examining Dark Triad traits in relation to mental toughness and physical activity in young adults. *Neuropsychiatric disease and treatment, 12*, 229.

Sadeghi Bahmani, D., Hatzinger, M., Gerber, M., Lemola, S., Clough, P. J., Perren, S., ... & Brand, S. (2016). The origins of mental toughness–prosocial behavior and low internalizing and externalizing problems at age 5 predict higher mental toughness scores at age 14. *Frontiers in Psychology*. Advance online publication. doi: 10.3389/fpsyg.2016.01221

St Clair-Thompson, H., Giles, R., McGeown, S. P., Putwain, D., Clough, P., & Perry, J. (2016). Mental toughness and transitions to high school and to undergraduate study. Educational Psychology. Advance online publication. http://dx.doi.org/10.1080/01443410.2016.1184746

St Clair-Thompson, H., Bugler, M., Robinson, J., Clough, P., McGeown, S. P., & Perry, J. (2015). Mental toughness in education: Exploring relationships with attainment, attendance, behaviour and peer relationships. *Educational Psychology 35*(7), 886-907.

Tabachnick, B. G., & Fidell, L. S. (2001). *Using Multivariate Statistics* (4th ed.). Boston, MA: Allyn and Bacon.

Veselka, L., Schermer, J. A., & Vernon, P. A. (2012). The Dark Triad and an expanded framework of personality. *Personality and Individual Differences, 53*, 417–425.

Table(s)

Tables

Table 1. Test-Retest Reliabilities for Mental Toughness, Narcissism, School Grades and School Achievement

Variable	Mental Toughness 2	Narcissism 2	Mathematics 2	Literacy 2	Second Language 2	School Achievement 1	School Achievement 2
Mental toughness 1	.74***	—	—	—	—	—	
Narcissism 1	—	.69***	—	—	—	—	
Mathematics 1	—	—	.73***	—	—	—	
Literacy 1	—	—	—	.73***	—	—	
Second Language 1	—	—	—	—	.76***	—	
School Achievement 1	—	—	—	—	—	—	
							.83***

*Note: N = 339; ***p ≤ .001. Standard deviations are given in parentheses. Numbers 1 and 2 after variable names refer to the assessment waves.*

Table 2. Correlations between School Grades at Wave 1 and Wave 2

Variable	Mathematics 1	Literacy 1	Second Language 1	Mathematics 2	Literacy 2	Second Language 2
Mathematics 1	—	.47***	.45***	—	.41***	.42***
Literacy 1	—	—	.56***	.46***	—	.54***
Second Language 1	—	—	—	.39***	.56***	—
Mathematics 2	—	—	—	—	.48***	.44***
Literacy 2	—	—	—	—	—	.64***
Second Language 2	—	—	—	—	—	—

*Note: N = 339; ***p ≤ .001. Number 1 after the name of a variable refers to the assessment of this variable at wave 1. Number 2 after the name of a variable refers to the assessment of this variable at wave 2.*

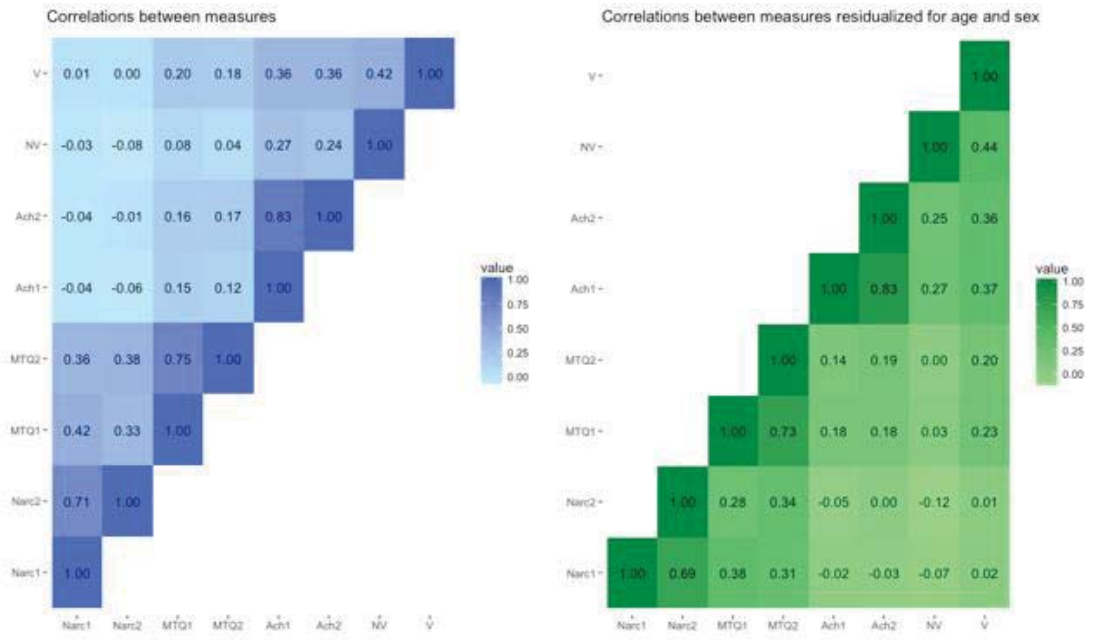
Table 3. Longitudinal Associations between Mental Toughness (Wave 1) and Narcissism (Wave 1) with School Achievement (Wave 2)

N=339							
Independent Variable: Mental Toughness Wave 1							
Dependent Variable	B	β	t	95% CI for β Lower Bound	95% CI for β Upper Bound	R^2	p-value
School Achievement Wave 2	.20	.11	2.20	.02	.38	.012	.02
Independent Variable: Narcissism Wave 1							
	B	β	t	95% CI for β Lower Bound	95% CI for β Upper Bound	R^2	p-value
School Achievement Wave 2	-.53	-.03	-.58	-.22	.12	.001	.55

Note: The "B" and "β" refer to the unstandardized and standardized regression coefficients respectively.

Figure(s)

Figure 1: *Heat map presenting correlations between measures before and after residualizing for age and sex*



Note. Narc = Narcissism; MTQ = Mental Toughness; Ach = Achievement; V = Verbal ability; NV = Non-verbal ability; 1 = Wave 1; 2 = Wave 2

Figure 2. *Mediation Model of Narcissism (Wave 1) on School Achievement (Wave 2) through MT (Wave 2)*

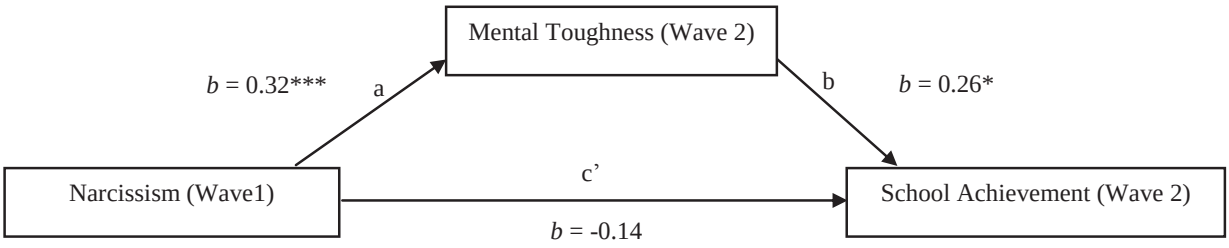


Figure 2. Mediation model of the indirect effect of narcissism (Wave 1) on school achievement (Wave 2) through MT. *b's* represent the unstandardised regression coefficients (***$p < .001$; *$p < .05$). Total effect: $b = -0.052$, $SE = 0.089$, $p = .55$; (a) The effect of narcissism (Wave 1) on MT (Wave 2); (b) the effect of MT on school achievement (Wave 2) after controlling for narcissism; (c') the direct effect of narcissism (Wave 1) on school achievement (Wave 2).

Supplementary Material

Section 1.

Statistical Analyses

Validating the New MTQ-10 Measure. Missing data were imputed by regression, considering that less than 5% of the data was missing. After screening the data, the sample was divided into two subgroups of wave 1 (W1) and wave 2 (W2) to verify the factor structure of the scale. Using AMOS 23 software, confirmatory factor analyses (CFA) were performed on the MTQ-10 initially with the W1 data to test the assumption that a single factor comprised the measure. The most plausible model from the W1 data was replicated using the W2 data to cross-validate the confirmed model. The validated model across W1 and W2 data was assessed for measurement invariance over time using multigroup CFA. Goodness of fit was evaluated through Chi-square, CFI (Comparative Fit Index), IFI (Incremental Fit Index), RMSEA (Root Mean Squared Error of Approximation) and SRMR (Standardized Root Mean Squared Residual). For these indices, literature suggests that values above .86 for CFI and IFI are marginal; values equal to or greater than .90 are deemed acceptable; and values close to 1 are indicative of good fit (Nigg, Nikolas, Miller, Burt, Klump, & von Eye, 2009). For RMSEA and SRMR, values of .08 and lower are considered optimal (Hair, Black, Babin, Anderson, & Tatham, 2009). For the initial factor structure assessment, modification indices (MI) were also examined to identify parameter misfit.

Through multigroup CFA, two models were tested: For the first model, parameters were freely estimated for each group, with only the plausibility of the factor structure tested. In the second model, factor loadings were constrained to be equal between groups. The CFI and chi-square differences between the models were considered. Finally, composite reliability (CR) was

calculated to determine the internal consistency of items in the factor structure. CR values above .60 are considered acceptable (Diamantopoulos & Siguaw, 2000). For completeness, Cronbach's alpha was reported along with test-retest reliability from W1 to W2 responses. The intraclass correlation coefficient was used to assess test-retest reliability with values greater than .70 considered acceptable (Cicchetti, 1994).

Descriptive Statistics and Covariates. Demographics and questionnaire data were examined using Descriptive Statistics in SPSS Version 24 (IBM Corp. Released 2016. IBM SPSS Statistics for Windows, Version 24.0. Armonk, NY: IBM Corp). Kurtosis and skewness, were calculated to test for normality in the distribution (*skewness < 1.0*). All variables were approximately normally distributed. Cronbach's alphas were calculated to estimate the measures' internal consistency (see Table S1 below for details).

Previous research (e.g. Marchant et al., 2009; Lin et al., 2017; Paulhus & Williams, 2002) has shown that age and sex influence MT and narcissism. In our sample males scored significantly higher than females on MT at wave 1 [F (1, 338) = 35.34, p < ,001, η^2 = .09] and wave 2 [F (1, 338) = 21.44, p < ,001, η^2 = .06]; and on narcissism at wave 1 [F (1, 338) = 18.50, p < ,001, η^2 = .05] and wave 2 [F (1, 338) = 14.36, p < ,001, η^2 = .04]. Age showed a very weak correlation with school achievement at wave 1 (r = .11, p < .05). As such, age and sex were used as covariates in the partial correlation, multiple linear regression and mediation analyses. To explore whether subclinical narcissism and MT associate significantly with school achievement, when controlling for cognitive ability, a mean composite score of two cognitive tests (RPM and IVT-80) was used as a covariate in the aforementioned analyses.

Correlations, Multiple Linear Regression, Cross-Lagged and Mediation Analyses. Partial correlations were used to test the first hypothesis (MT will associate positively with

subclinical narcissism); multiple linear regressions were used to test the second hypothesis (MT and subclinical narcissism will associate positively with school achievement). Cross-lagged panel analysis was used to investigate the longitudinal associations between MT, narcissism and achievement across collection waves 1 and 2 (hypothesis 3). Cross-lagged analyses were run using the MPlus 7.0 software (Muthén & Muthén, 1998-2012). To test the fourth hypothesis, that individual differences in MT mediate the relationship between subclinical narcissism and school achievement, hierarchical regression analysis was performed using the PROCESS macro for SPSS (Version 2.13; Hayes, 2012). The direct effect provides an estimate of the effect of the independent variable (IV) on the dependent variable (DV). The indirect effect of the IV on the DV via a potential mediator (M) can be estimated from bias-corrected bootstrap 95% confidence intervals. The total effect provides an estimate of the combined direct and indirect effects. In the present study we used 5,000 bootstrap resamples.

Section 2.

MTQ-10 Psychometric Properties

A confirmatory factor analysis of the one-factor model for the MTQ-10 with the W1 data revealed unsatisfactory fit on all indices but SRMR, χ^2 (35, N = 343) = 147.88, p < .001, CFI = .84, IFI = .84, SRMR = .07, RMSEA = .09 (CI of .08 to .11). An inspection of modification indices (MI) revealed that allowing within-item error correlations between items 4 and 9, 2 and 8, 2 and 3, and 3 and 8 would improve model fit, χ^2 (31, N = 343) = 98.33, p < .001, CFI = .90, IFI = .90, SRMR = .05, RMSEA = .08 (CI of .06 to .09). Byrne (2016) recommends that item errors should not be correlated unless there exists appropriate justification. In this case, a rationale existed given items 4 and 9 both belonged to the *Challenge* subscale from the initial MTQ-48; and items 2, 8, and 3 were all reverse-scored items representing a degree of

commonality in item phrasing. The suitability of the one-factor model can be further supported in relation to its factor loadings, as all items loaded higher than the minimum threshold of .30 (Brown, 2015) apart from items 2 and 3 (loadings of .28 and .23 respectively). This final model including within-item correlations was specified and tested with the W2 data, and revealed acceptable fit, thus validating the one-factor structure of the model, χ^2 (31, N = 343) = 95.94, p < .001, CFI = .91, IFI = .91, SRMR = .06, RMSEA = .07 (CI of .06 to .09). As with the W1 data, all items loaded higher than the minimum threshold of .30 apart from items 2 and 3 (loadings of .22 and .18 respectively).

The multigroup CFA compared W1 with W2 data to verify the equivalence of parameters across time. The multigroup analyses indicated acceptable fit for the model with parameters freely estimated, χ^2 (64, N = 343) = 202.76, p < .001, CFI = .90, IFI = .90, SRMR = .05, RMSEA = .06 (CI of .05 to .07). The model with constrained factor loadings suggested acceptable fit, χ^2 (71, N = 343) = 215.31, p < .001, CFI = .90, IFI = .90, SRMR = .06, RMSEA = .06 (CI of .05 to .06). The difference between the CFI indices did not exceed .01. Also, a chi-square (χ2) difference test revealed a non-significant difference between models: χ^2 (7, N = 343) = 12.55, p = .08, suggesting that both the factor structure of the scale and the factor weights of the items are similar between W1 and W2. Composite reliability values for the final one-factor solution were acceptable (greater than .60) for both W1 (ρc = .77) and W2 (ρc = .73). Cronbach's alpha additionally indicated good internal consistency for W1 (α = .76) and W2 (α = .75). The test-retest intraclass correlation coefficient comparing W1 and W2 was .75 (CI of .70 to .80), indicating acceptable reliability of the measure over time. Overall, the results provide support for the suitability and stability of the one-factor solution of the MTQ-10.

Table S1. Descriptive Statistics for Mental Toughness, Subclinical Narcissism and School Grades (Wave 1 and Wave 2)

Variable	Mean	Variance	Median	Range	Kurtosis	Skewness	Cronbach's α
Mental Toughness 1	3.22 (.54)	.30	3.18	2.91	.07	-.05	.76
Mental Toughness 2	3.18 (.55)	.30	3.18	3.36	.71	.07	.75
Narcissism 1	2.86 (.53)	.29	2.77	3.56	.46	.29	.65
Narcissism 2	2.90 (.58)	.33	2.88	3.11	.35	.20	.69
Mathematics 1	6.54 (1.44)	2.07	7.00	6.00	-.68	-.05	—
Mathematics 2	6.80 (1.25)	1.57	7.00	6.00	-.34	-.001	—
Literacy 1	6.90 (.98)	.96	7.00	5.00	-.23	.23	—
Literacy 2	7.06 (.98)	.97	7.00	6.00	-.049	-.005	—
Second Language 1	6.84 (1.23)	1.51	7.00	5.00	-.63	-.03	—
Second Language 2	7.00 (1.16)	1.36	7.00	6.00	-.40	-.005	—
School Achievement 1	6.76 (.99)	.98	6.66	4.33	-.70	.15	—
School Achievement 2	6.95 (.93)	.87	7.00	5.67	-.19	.33	—

Note: N = 339. Standard deviations are given in parentheses. Numbers 1 and 2 after variable names refer to the assessment waves.

Table S2. Multiple Linear Regressions between Mental Toughness at Wave 1 and School Grades at Wave 2

N=339							
Independent Variable: Mental Toughness at Wave 1							
Dependent Variable	B	β	t	95% CI for β Lower Bound	95% CI for β Upper Bound	R^2	p-value
Mathematics (Wave 2)	.21	.08	1.45	-.075	.50	.006	.14
Literacy (Wave 2)	.27	.15	2.87	.08	.45	.02	.004
Foreign Language (Wave 2)	.09	.04	.80	-.14	.33	.002	.42

Note: The "B" and "β" refer to the unstandardized and standardized regression coefficients respectively.

Table S3. Multiple Linear Regressions between Narcissism at Wave 1 and School Grades at Wave 2

N=339							
Independent Variable: Narcissism at Wave 1							
Dependent Variable	B	β	t	95% CI for β Lower Bound	95% CI for β Upper Bound	R^2	p-value
Mathematics (Wave 2)	-.22	-.08	-1.57	-.50	.05	.007	.11
Literacy (Wave 2)	.15	.08	1.63	-.03	.33	.007	.10
Foreign Language (Wave 2)	-.04	-.018	-.35	-.27	.19	.00	.72

Note: The "B" and "β" refer to the unstandardized and standardized regression coefficients respectively.

References

Brown, T. A. (2015). *Confirmatory Factor Analysis for Applied Research* (2nd ed.). New London, UK: Guildford Press.

Byrne, B. M. (2016). *Structural equation modeling with AMOS: Basic concepts, applications, and programming* (3rd ed.). New York, NY: Routledge.

Cicchetti, D. V. (1994). Guidelines, criteria and rules of thumb for evaluating normed and standardized assessment instruments in psychology. *Psychological Assessment, 6*, 284-290.

Diamantopoulos, A., & Siguaw, J. A. (2000). *Introducing LISREL: A guide for the uninitiated*. Leicester, UK: Sage.

Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (2009). *Análise multivariada de dados*. Porto Alegre, RS: Bookman.

Hayes, A. F. (2012). PROCESS [Macro]. Retrieved from http://afhayes.com/introduction-to-mediation-moderation-and-conditional-process-analysis.html

IBM Corp. Released 2016. IBM SPSS Statistics for Windows, Version 24.0. Armonk, NY: IBM Corp.

Marchant, D. C., Polman, R. C. J., Clough, P., Jackson, J. G., Levy, A. R., & Nicholls, A. R. (2009). Mental toughness: Managerial and age differences. *Journal of Managerial Psychology*, *24*(5), 428-437.

Muthén, L.K. and Muthén, B.O. (1998-2012). Mplus User's Guide. Seventh Edition. Los Angeles, CA: Muthén & Muthén

Nigg, J. T., Nikolas, M., Miller, T., Burt, S. A., Klump, K. L., & von Eye, A. (2009). Factor Structure of the Children's Perception of Interparental Conflict Scale for Studies of Youths with Externalizing Behavior Problems. *Psychological Assessment*, *21*, 450-456.